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AGRICULTURE: LAND AND LIFE

Year Two / Module 1

Managing Soil Resources

Student Support Guide



**Distance
Learning**

Alberta
EDUCATION

Agriculture: Land and Life Year Two

Module 1

STUDENT SUPPORT GUIDE



**Distance
Learning**



Note to the Parent or Guardian

This Student Support Guide contains answers to activities in the Module Booklets. It should be kept secure by the parent or guardian if the student is under 16 years of age. Younger students should not have access to this Guide except under supervision.

This Student Support Guide does not contain the answers to the Assignment Booklets. The Assignment Booklets will be graded by the student's distance education teacher.

Agriculture: Land and Life Year Two
Student Support Guide
Module 1
Managing Soil Resources
Alberta Distance Learning Centre
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FOREWORD

Welcome to distance learning. You have chosen an alternate form of learning that allows your student greater freedom in some ways than traditional classroom learning. It also requires discipline and motivation for your student to carry on without someone standing behind and pushing as a classroom teacher often does. For junior high students distance learning is generally more effective if there is a learning facilitator. A parent or guardian of a student studying at home can be this person. As the learning facilitator, you will have to help motivate and discipline your distance learning student.

This guide has been developed to assist you. It begins by familiarizing you with the process of learning at a distance. You will learn what is expected of a learning facilitator, how the course is set up, and how to help your student complete the course successfully. The remainder of this guide and all other guides (there is one for every module) contain guidance and answers to the activities your student is expected to do. Begin by reading the introductory material in this guide.

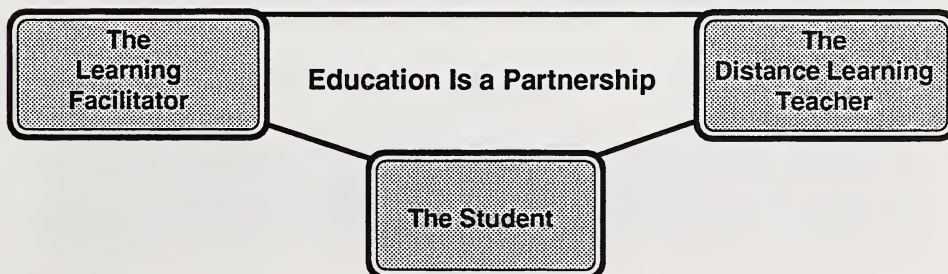
DISTANCE LEARNING

The Role of the Learning Facilitator

As the learning facilitator, you have a key role in determining the success your student has taking this course. Students need encouragement and the confidence of knowing that the course is important to their future.

You are expected to perform the following duties:

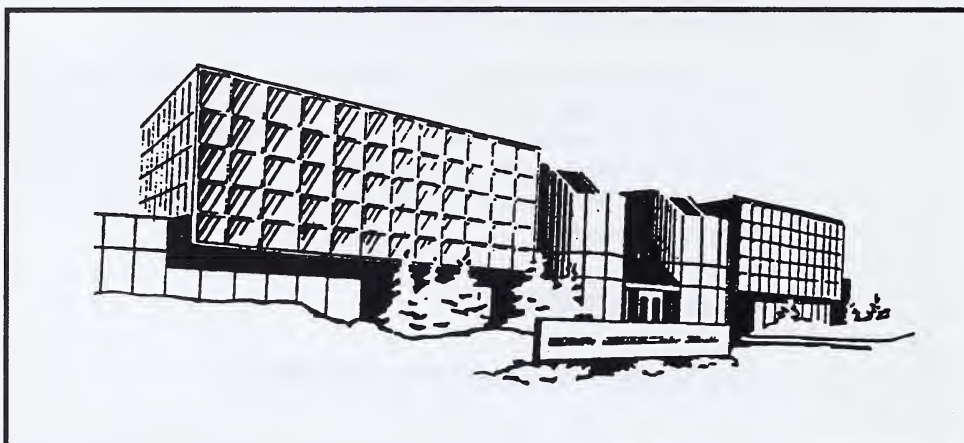
- Be the contact person with the Alberta Distance Learning Centre.
- Ensure the student has a suitable study area.
- Ensure the safe handling of media.
- Ensure the student establishes a timetable.
- Supervise the student's completion of modules.
- Monitor the student's progress.
- Provide the student with encouragement.
- Check the student's work, or supervise the student's checking of the activities.
- Supervise the submission of assignments.



The Alberta Distance Learning Centre

The Alberta Distance Learning Centre helps those who want to learn at a distance.

The Alberta Distance Learning Centre



The Alberta Distance Learning Centre is a branch of Alberta Education. It helps educate approximately 40 000 students a year from all parts of Alberta, the rest of Canada, and all over the world. Not all of these students study on their own. Some students use distance learning courses to work at their own pace but work in schools or institutions under the guidance of a learning facilitator. The Alberta Distance Learning Centre provides materials for grades 1 to 9, for the core subjects in high school, and for many option courses. All courses follow Alberta curriculum guidelines.

The building, located in Barrhead, Alberta, is about 6 500 m². Barrhead is located 120 km northwest of Edmonton. It contains a modern printing and typography unit, an instructional design unit, a teaching unit, a shipping and mailing unit with its own postal code, and a student services unit. The staff numbers about 200. Some teaching staff work in their homes on a contract basis.

How the Assignments Are Processed



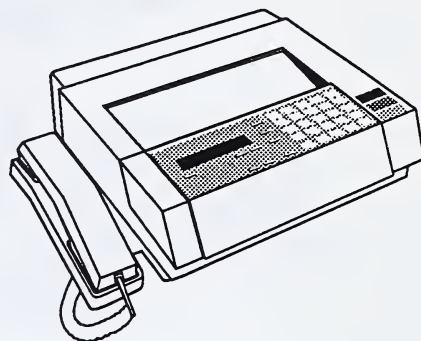
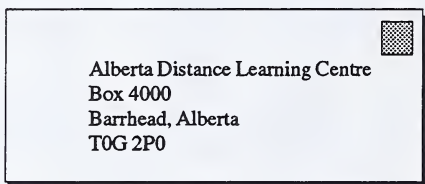
1. Your student's assignments are received at the Mailing Department and sent to the Recording Department.
2. At the Recording Department materials are separated and labels are checked to see that they are correct. Assignments are sorted into elementary, junior high, and senior high subject areas.
3. All assignments and tests are entered into the computer.
4. Depending on the teacher to whom the student is assigned, the student's assignments come to the in-house teachers at the Alberta Distance Learning Centre or go to the contract teachers who work at home.
5. Corrected assignments are returned to the Recording Department. The marks are entered into the computer.
6. The assignments are put into envelopes and mailed back to the students.

It is important to label your materials carefully so that they are not lost in the masses of paper that are sent to the school.

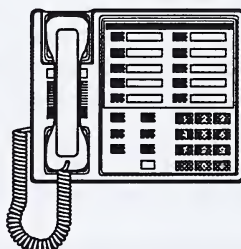
How to Make Contact

As the learning facilitator, one of your important roles is to be the contact person with the Alberta Distance Learning Centre. Staff members at the Alberta Distance Learning Centre may need to contact you from time to time. Also, it may be necessary for you to contact us. If you need help or information, you may contact the Alberta Distance Learning Centre in one of four ways.

1. You may write a letter to be mailed or faxed. The fax number is 674-6588.



2. You may call the Alberta Distance Learning Centre.



- If you live in the Barrhead area, call 674-5333.
- If you live in other parts of Alberta, you may phone using the Government RITE System. Dial the number of the RITE Operator under your local Government of Alberta listings and ask for the Alberta Distance Learning Centre (674-5333).
- If you live in an area of Alberta not serviced by the RITE System, simply dial "0" and ask for "ZENITH 22333"; then ask for the Alberta Distance Learning Centre.

3. Come to visit the Alberta Distance Learning Centre in Barrhead (120 km northwest of Edmonton). Office hours are 8:15 a.m. to 4:30 p.m., Monday to Friday, except on statutory holidays. Phone ahead if you wish to see a particular person.



4. Contact the Edmonton Study Centre. If you live in Edmonton, you may contact the Edmonton Study Centre for information, some supplies, and as a drop-off point for assignments. The hours are 8:15 a.m. to 4:30 p.m., Monday to Friday.

Edmonton Study Centre
9th Floor
Harley Court
10045-111 Street
Edmonton, Alberta
Telephone 427-2766

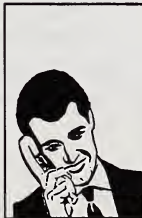
When you are concerned about course content, ask for a specific teacher or a particular department. When you are concerned about registrations, testing, or accounts, ask for Student Services.



Student



Student



Teacher



Student Services



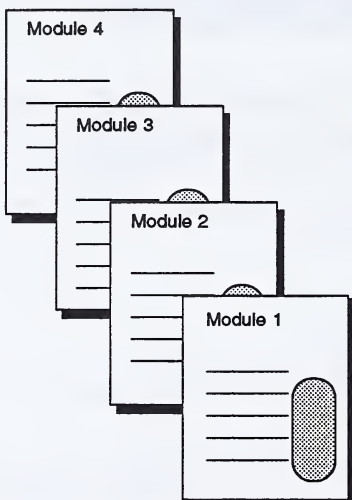
Registrations

ALL ABOUT AGRICULTURE: LAND AND LIFE YEAR TWO

How the Course Is Designed

This new learning package involves many other components in addition to the student support guide.

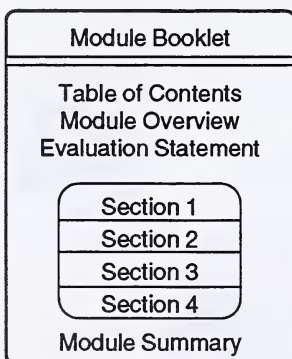
Modules



The print components involve booklets called modules.

The structure of the modules in Agriculture: Land and Life Year Two follows a systematic design. Each module begins with a table of contents, a module overview, and an evaluation statement.

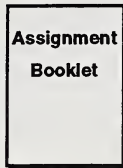
The body of the module is made up of closely related sections. The number of sections will vary from module to module, but each section contains student activities that develop strategies, knowledge, and skills centred around a theme.



At times the student and the learning facilitator are allowed to choose the activity that best suits the student's needs and interests. Other activities are optional. This flexibility caters to each student's personal situation.

The module summary focuses on the main ideas that the student has learned. This is an important part of the module because it discusses how all the ideas in the sections are related.

Assignment Booklets



Accompanying each module is an assignment booklet. The student's mark for each module will be determined by how well they do the assignments in the assignment booklet. If they are having difficulties, they should go back and review the appropriate section in the module booklet. Students are directed to the assignment booklet while working through the module booklet. The assignments usually follow several activities in the module booklet.

There are a number of assignments in the assignment booklet. The total of these assignments is 100 marks.

When the student has completed the assignment booklet, it should be promptly mailed for corrections to the Alberta Distance Learning Centre. While you are waiting for feedback from the teacher, you are encouraged to have the student start the next module.

Media



VIDEOCASSETTE



PRINT ALTERNATIVE
PATHWAY

The learning package also includes reference to media. Pathways have been developed so students can use a variety of media to learn what is important. These different routes have been included to suit different learners. Wherever videos have been included, a print pathway is also available. This way, if the media isn't available or desired, a student can follow the print pathway and still successfully complete the course.

Textbook



Module 1 – Managing Soil Resources has been designed to include references to the textbook, *The Living Soil: A Renewable Resource*.

A Description of the Agriculture: Land and Life Program

The Agriculture: Land and Life program for junior high school students provides a three-year sequence of complementary courses. The objective of the program is to provide a broad awareness of the economic, social, and scientific realities of the agricultural enterprise. Learning is introduced in meaningful contexts through hands-on activities and print or media pathways. Through a variety of pathways, students can pursue their personal interests while broadening their understanding of the world in which they live.

The course has been designed to be of interest to both urban and rural students with a balance of perspectives including those of consumers, home gardeners, and workers in food production and processing.

The emphasis of the program is on awareness and insight rather than on specific skills.

Goals of the Agriculture: Land and Life Program

- to develop an awareness of the diversity of agricultural activity in students' local areas, in Alberta, and in the national and international communities
- to develop critical-thinking and problem-solving skills in the process of examining agricultural problems and practices
- to acquire knowledge about agricultural production and processing
- to recognize relationships between producers, processors, marketers, and consumers
- to appreciate agriculture for its economic significance, career opportunities, and for its impact on the quality of life
- to acquire knowledge and develop skills applicable to plant and animal care in both urban and rural settings
- to develop a resource management perspective, recognizing areas where personal and public decision making are needed
- to acquire an awareness of agricultural technologies, including an examination of emerging technologies as well as those of the past and present
- to develop an awareness of societal issues and concerns that are related to agriculture
- to develop an awareness of agriculture's scope in urban areas

Program Organization

The program content is organized into themes which are repeated over the three-year sequence. These themes are developed in a series of modules for each year of the program. Students may enter the program at any year and complete the modules in any order. A suggested minimum time commitment for each module is included in the following table.

Theme	Year One	Year Two	Year Three
Production, Processing, and Marketing	Module 1 Milk and Milk Products 20 hours	Module 3 Meat and Meat Products 20 hours	Module 1 Field Crops and Energy 20 hours
Technology and Research	Module 2 People, Machines and Grain 20 hours	Module 2 Greenhouse Technology 20 hours	Module 2 Biotechnology 20 hours
Resource Management	Module 3 Managing Water Resources 20 hours	Module 1 Managing Soil Resources 20 hours	Module 3 Managing the Land 20 hours
	Module 4 What Is Agriculture? 15 hours	Module 4 Part A: What Is Agriculture? or Part B: Project 1/Project 2 15 hours	Module 4 Student Projects 15 hours

Description of Agriculture: Land and Life Year Two

The modules included in the Agriculture: Land and Life Year Two program are summarized as follows:

Module 1: Managing Soil Resources

Soil is a basic resource for food production. The quality of the soil can determine the success of a farm. The degradation of soil quality is a major concern. This module examines the important characteristics of soil and considers some of the problems of soil management.

Module 2: Greenhouse Technology

Growing plants can be thought of as a series of planned interventions that will enhance the growth of a food crop. Students will learn about these interventions, and explore some of their implications, through a series of practical activities. Because many of the activities in this module must be monitored over time, it is recommended that students complete them while working on Module 1 or Module 3.

Module 3: Meat and Meat Products

This module is a case study of meat as a nutritious food. Alternate foods with similar nutrient values are also discussed. This unit will also explore how meat is produced, processed, and packaged to satisfy the needs and preferences of consumers. Because many of the activities in this module must be monitored over time, it is recommended that students complete them while working on Module 1 or Module 2.

Module 4: Part A – What Is Agriculture?

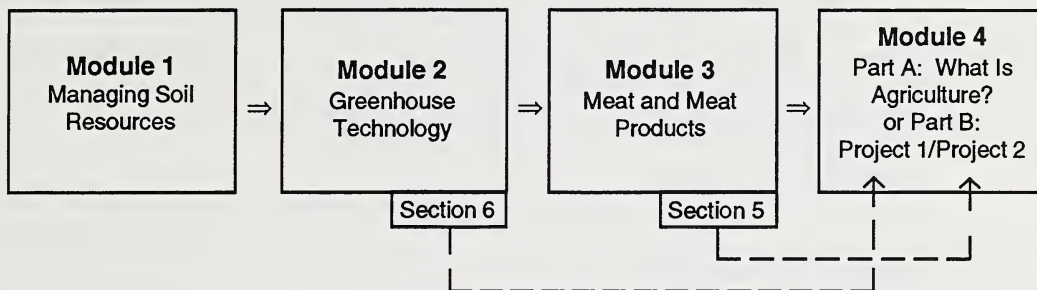
Part B – Project 1/Project 2

Part A is a comprehensive review of agricultural activity to provide students with a sense of its diversity and scope. The perspective adopted in Part A is that agriculture involves more than just the farm, and that the impact of agriculture can be seen in all of society. Part A examines agriculture at a variety of levels from local to global and introduces students to Alberta's role as both an importer and an exporter of agricultural commodities.

Part B consists of two projects – a plant project and an animal project. Since the plant and animal projects need to be done over a period of time, the instructions for doing the plant project are located in Section 6 of Module 2, and the instructions for the animal project are located in Section 5 of Module 3. However, the assignments for both projects are located in the Module 4 Assignment Booklet: Part B. This allows students time to pursue the project work while completing the rest of the material in the course.

Note: Students who previously completed the Agriculture: Land and Life Year One program, and are now taking the Year Two program, must do Part B of Module 4.

Students who entered the Agriculture: Land and Life program at the Year Two level, must do Part A of Module 4.



Symbols and Terms Used in This Course

Symbols

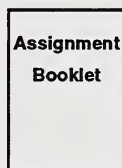
Agriculture: Land and Life Year Two has a number of symbols in the margins. These symbols are used throughout the course.



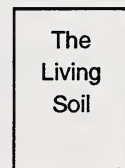
Videocassette



Print Alternative
Pathway



Assignment Booklet



Textbook for
Module

Be sure that you and the student become familiar with these symbols.

Terms

When new terms or concepts are introduced in the course, it is important that the student understand that the terms are new and that they should read carefully to fully understand what the terms mean. The course has been designed so that new terms or concepts are given special attention. They are **defined** and **explained** within the sentence or paragraph or the terms are printed in bold face with their definitions included in the glossary, which is located at the beginning of the appendix in each module booklet. As you supervise, make sure the student knows what the new terms and concepts are and what they mean.

COURSE MATERIALS

Materials

Materials Supplied	Materials Required	Optional Materials
Courseware Student Support Guides (4) Module Booklets (4) Assignment Booklets (4)	Textbook <i>The Living Soil: A Renewable Resource</i> for Module 1	Please see the following chart.

Optional Components

Equipment (Hardware)	Media	Materials
<ul style="list-style-type: none"> • VCR • Video camera • Audiocassette player/recorder 	<ul style="list-style-type: none"> • videocassettes (Videocassettes used in the course may be available from the Alberta Distance Learning Centre or call your local school authorities.) • Some activities and assignments may be submitted using a videotape format. • Some activities and assignments may be submitted using audiocassettes. 	<ul style="list-style-type: none"> • Some modules or projects require materials that can only be acquired at certain times of the year. If so, these materials will be listed in the Student Module Booklets as part of Preparation (see Contents). As an alternative you may wish to adjust the order in which modules are completed so that materials can be easily obtained. • Some activities and assignments will require materials such as soil samples, flower pots, plant seeds, animals, or animal feeds. In most cases students will have an alternative print pathway not requiring these materials. However, to get the maximum benefit and satisfaction from the course, the hands-on activities are recommended.

When you receive your course materials, you should take time to look carefully at what you received. **Take note that your entire course may not be sent at one time.** If you received the wrong course or your course is defective in any way, notify the Student Services Department of the Alberta Distance Learning Centre immediately.

Handling the Courseware

Courses may involve audiocassettes and/or videocassettes. Whether the material is loaned or purchased, it is important to take care of these items. Scratches, dirt, grease, extreme temperatures, or magnetic fields such as those in electric motors will damage them.

EVALUATION

There are two kinds of evaluation used in the course: informal and formal. As the learning facilitator you will take part in the informal evaluation.

Informal Evaluation

The course contains two types of activities. In the module booklets there are learning activities that include basic practice and questions that help guide the students to a better understanding. It is important that these activities are corrected as soon as possible so the students get immediate feedback to confirm and clarify their understanding before they go on.

In a classroom these types of activities would be corrected as they are completed by the teacher or by the students. In distance learning courses at the high-school level, the answers for these activities are included in the appendix of each module booklet so that the students can mark the activities themselves. **At the elementary and junior-high level, correcting the activities and discussing the results is one of the most important duties of the learning facilitator.**

When the student has completed an activity, you should skim over it before correcting to be sure the student has spent enough time and effort on the activity.

When checking a student's work, first focus on the work the student has done correctly and then comment on the student's effort. Then, if necessary, spend time clearing up any misunderstandings.

Following are a few suggestions that have proved to be constructive ways of handling errors. First, stop to consider why there are errors. Ask yourself the following questions:

- Is the student repeatedly making the same mistakes or do the errors appear to be random?
- Do the errors appear to be the result of carelessness?

If the student is repeatedly making the same mistakes, you may need to read through that section and explain in your words what the main ideas are.

If the error is random and doesn't have a serious impact, then it is worth ignoring.

If the error appears to be careless, you may need to

- check to see if the student understands the directions
- relate the activity where the errors occur to some meaningful aspect of the student's life
- discuss the information with the student
- have the student slow down
- give the student a rest

Always instruct the student to correct incorrect answers. The module booklet becomes an important reference when doing the assignments, and it is essential that it is accurate.

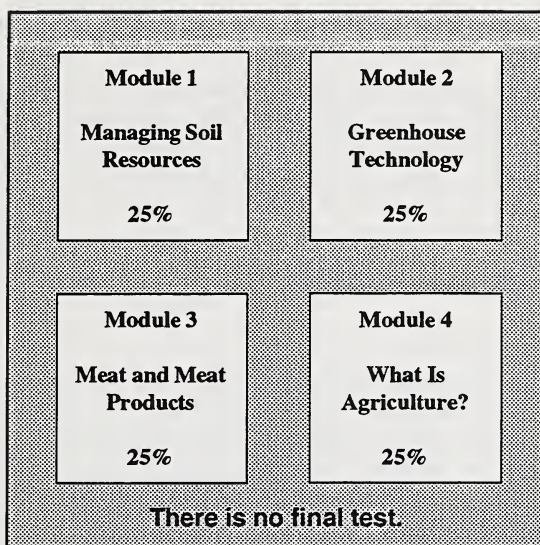
Remember, it is very important that students not only learn from their corrections, but that they also realize that making mistakes is a normal part of learning.

You may decide to let the student correct some of the activities after you have ensured that the student has spent enough time and effort on the activity. Make sure that you see the activity with its corrections before letting the student go any further in the module booklet.

It is of little value to students if you do their work. How many items are incorrect is not the most important thing, but how the mistakes are handled. Sometimes it is easier when you're guiding the student to put in the answers, but it does not help the student learn the concept. Activities with examples have been included with the student modules to provide guidance for the students.

Formal Evaluation

Formal evaluation is based on the assignments in the assignment booklets which are marked by a distance learning teacher. There is an assignment booklet for each module in the course. The assignments are based on the work the student has completed in the module. The student may refer to the module booklet while completing the assignments. The following chart shows the percentage of the final course mark assigned to each module. The final mark is determined by how well the student does on all the modules. There is no final test for Agriculture: Land and Life Year Two.



Module Evaluation

Each module submitted to the distance learning teacher is evaluated on the basis of the student's demonstrated understanding of the concepts taught in that module, completeness of work, neatness, and legibility. A letter grading is then assigned which follows the scale of percentage or performance equivalencies below.

A	80% – 100%	Outstanding
B	65% – 79%	Good
C	50% – 64%	Satisfactory
D	40% – 49%	Needs Improvement
F	0% – 39%	Unsatisfactory
I	Incomplete	Follow the distance learning teacher's directions and return the entire module in order to receive a grading.
R	Repeat	

Report Cards

Report cards are mailed twice a year – in October and in February – to all nonschool students under sixteen years of age. The principal or superintendent is also sent a copy of the report card. This card shows the number of modules completed in the course, the average grading per module, and the final mark received for the completed course.

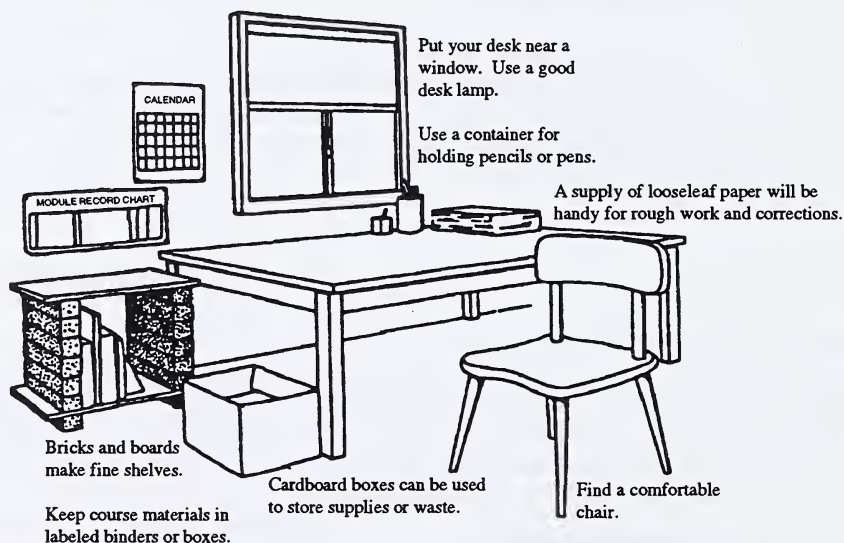
STARTING OUT RIGHT

Proper planning, organization, and good study habits will help your student to succeed in academic studies. This section of the guide will give you and your student some idea of how to use time efficiently so that the student can achieve predetermined goals. If you are new to distance learning, both you and the student will probably benefit from the tips on time management and study habits in this section.

Setting Up Shop

Probably one of the best ways to ensure success in distance learning is to establish a study corner. This is a quiet, well-lit area where the student can leave books, papers and supplies. It should be an area where there are no distractions – telephone, radio, television, or people engaged in other activities. Find the best place for studying in your home. A comfortable chair and sufficient work space (table or desk) are essential. All necessary supplies, tools, materials, and books must be gathered. The work area could contain exercise equipment like barbells or even an exercise bike. When your student begins to feel sluggish, encourage a ten minute exercise break.

The following diagram may be helpful for organizing your study area.



Students should keep these things in their work area:

pens	atlas	extra paper	writing portfolio	return envelopes
pencils	eraser	thesaurus	library books	module materials
glue	dictionary	timetable	pencil crayons	ADLC phone number

An efficient student work place will help learning.

Time Management

There are so many demands on our time nowadays that we really must make the effort to organize our work and our activities. This organization or planning is called time management.



With distance learning, it is a necessity that the student plans a schedule. Your duty is to ensure that the student does some advance planning. Check the final plans to see if they are realistic.

Only you and the student know exactly how much time is available for completing a course. It does not matter too much what time of day the student does course work – this varies with the individual's situation. Distance education is flexible. To decide exactly how much time the student must take for studies, the student must set priorities. Together you must decide exactly when you wish to have the course completed. You must take into account time worked away from home, time needed for chores, and time needed for recreation and relaxation when you make this estimate.



Make a Weekly Plan

Discuss with your student the importance of weekly planning.

People who write for a living always have deadlines to meet. They cannot wait for inspiration. They discipline themselves to sit down and write for a number of hours every day. Whether they like it or not, they stick to a schedule. This determines success.

Work with your student to

- keep track of what your student usually does in a typical week
- plan the studies your student can do in a typical week
- keep a list of what your student must do each day and cross off each study task as it is completed
- find your student’s own best time to study
- set deadlines and stick to them
- not dwell on failures and get back on schedule

Have the student fill in a weekly timetable.

Sample Weekly Timetable

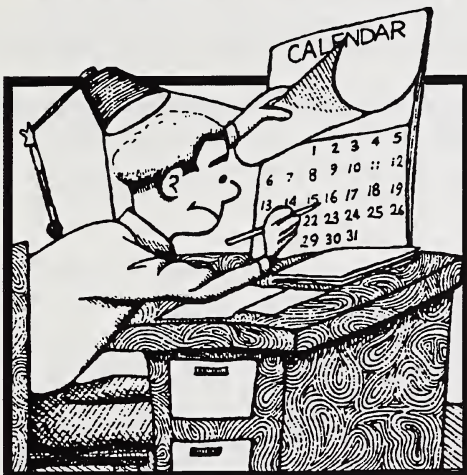
Begin when the student usually wakes up.
↓
Write in every hour.
↓
End when the student usually goes to bed.

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday

The student should keep track of every major activity. It is not wise to plan to use 100% of the student’s time. Allow for possible interruptions and jobs taking longer than planned.

Make a Monthly Plan

The next step is planning a monthly schedule with your student. The student should block off the days that are not available for studying.



- Count the days that are available between the start of the course and the desired finishing date.
- Allow time for review.
- Count the number of sections or modules that must be completed within this time.
- Estimate how many days are available to complete each section and each module.
- Make a monthly plan like the one below.

Sample Monthly Timetable

September

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
Total Work Days Available for Study						<input type="text"/>
Goal :						

Make a Course Plan

When you both have an idea of how much time is available every day, week, and month, look at a plan for completing the course(s) that the student is studying.

Modify these plans as circumstances change. Be flexible, but don't procrastinate.

Our experience has shown that a planned approach to module completion is far better than the hit-and-miss method of completing modules now and then, as you feel like it.

Sample Course Timetable

Course Name _____ Date of Starting _____				
Planned Completion Date _____ Actual Completion Date _____				
Module	Planned Completion Date	Actual Completion Date	Date Mailed	Date Returned

The student needs determination and perseverance to continue working independently.
The student also needs your positive support and interest to keep motivated.

Supervising the Completion of Modules

Try to ensure that the student is following the established timetable as closely as possible and that the target dates for module completions are being met. If, for some reason, the student misses time from studying, the student should spend additional time during the evenings or weekends, so as to complete the course(s) within the desired time limits.

When the student has completed the learning activities, you should allow the student to do the assignment in the assignment booklet. Afterwards you should go over the assignment to ensure the student has spent enough time on the assignment. When the entire assignment booklet is done satisfactorily, submit the assignment.

Basic Study Tips

Planning and good study habits will help the student to succeed in distance learning. Here is a short list of important tips to discuss with the student.

- Work together to make a course plan and weekly timetable, and follow them as closely as you can.
- Remember that mornings are usually better for concentration. Learning styles may vary from student to student.
- Check to see that all necessary materials and supplies are close by before starting work.
- Have the student take relaxation or exercise breaks between study periods.
- Be sure that the student completes all activities carefully and reviews corrections before moving to other assignments.
- Ensure that the student understands and follows directions carefully when completing activities. If the student is unclear about what to do, the student should then start by rereading the directions. If there are still problems, the student should discuss the activity with the learning facilitator. Sometimes reviewing the previous activities is helpful.
- Ensure that written responses are the student's own work.
- Encourage the student to switch subjects or activities before they become stale. If the student is working regularly and truly concentrating, one or two hours on one subject should be enough at one sitting.
- Have the student be sure that writing is neat, legible, and complete.
- Encourage students to discuss their reading and writing with you.

PROCEDURES

How to Send in Your Assignment Booklets

Assignment booklets, along with any other requested materials, should be submitted to the Alberta Distance Learning Centre as soon as possible after the completion of each module in order to obtain speedy, regular evaluation and feedback. The student can proceed with the next module while waiting for the return of the assignment booklet.

Please ensure that your student's file number is on all assignments, tapes, and disks sent to the Alberta Distance Learning Centre.

Report any change of address immediately. If a change is not reported, it is impossible for the school to forward information, letters, or test applications.

Mailing

The student is required to pay the postage on everything sent or returned to the Alberta Distance Learning Centre. To speed up handling, first-class postage is recommended on all assignments submitted.

The student is expected to perform assigned work and to correspond with teachers and administrative staff in an appropriate manner. The Alberta Distance Learning Centre reserves the right to cancel, without refund, the course of any student whose conduct is unbecoming.

Do not enclose letters concerning fees, guidance, additional courses, final tests, or general inquiries with assignments. Send these by separate mail to speed their handling and to avoid their being misplaced.

Dropping Off Your Assignment Booklets

You may drop off assignments at the Edmonton Study Centre or in Barrhead at the Alberta Distance Learning Centre.

Faxing Your Assignments

Be sure the covers of your assignment booklets are filled in correctly with the proper label attached.

Check to see that all response pages have been completed as directed.

Check to see that all faxing boxes located at the bottom of each response page have been clearly filled out.

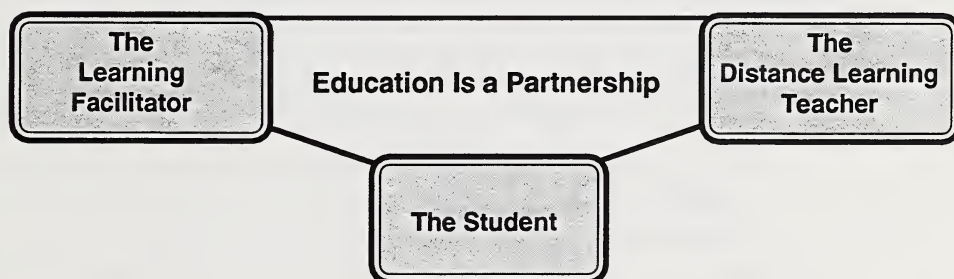
Costs for faxing assignments to the Alberta Distance Learning Centre are the responsibility of the student.

What to Do with Returned Assignment Booklets

Review returned assignments carefully with the student, noting the marks, teacher's corrections, and comments. The teacher may suggest that you make certain choices of activities in future modules to help you practise needed skills. Your teacher may also ask you to complete skill activities which are either included in the course or sent to you by the teacher. Returned assignments should be kept for future review and study.

SUMMARY

This introductory section of the Student Support Guide has been developed to assist you in your role as learning facilitator. Develop a routine with your student and a good working relationship. Remember, education is a partnership.



As the learning facilitator you have a key role in determining the success your students have in taking this course. Students need encouragement and the confidence of knowing that the course is an important part of their school work for the year. At times, they also need help to clear up misunderstandings or to confirm that what they are doing is correct.

The remainder of these Student Support Guides describe the modules of Agriculture: Land and Life in more detail. After the introductory pages of each module there are answers, models, explanations, and other tips generated by teachers who authored this course. So that the learning facilitator does not have to keep referring to the Student Module Booklets, the questions are reprinted from the Student Module Booklets, and the suggested answers are printed in italics. However, for more detailed instructions to the activities, the learning facilitator will need to refer to the information in the Student Module Booklets. Comments where applicable are made, and enclosed by a box, to guide the learning facilitator.

Correct and discuss the answers with the student as the student completes each activity. In this way the student receives immediate feedback to clarify and reinforce his or her basic understanding before he or she moves on to the next activity.

Towards the end of each section there are Follow-up Activities. Here the activities are separated into two strands: Extra Help and Enrichment. If students had some difficulties understanding the concepts and the activities, it is recommended that they do the Extra Help. If students had a clear understanding of the concepts and had few difficulties completing the activities, it is recommended that they do the Enrichment. As the learning facilitator, you should assist students in choosing the appropriate path.

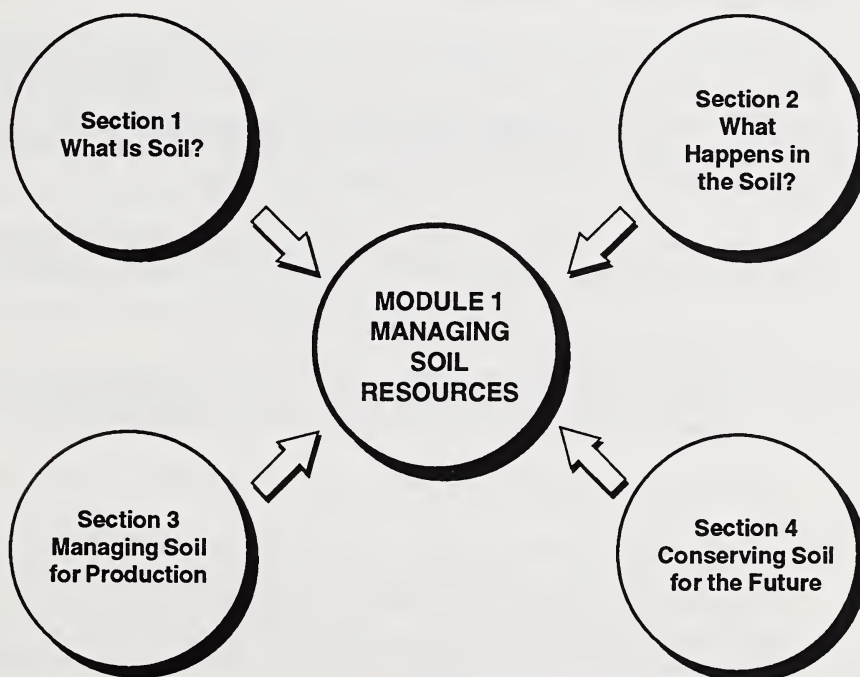
The assignments in the Assignment Booklets are to be done under the supervision of a parent or guardian. Ensure that the student always supplies his or her own written responses in the Assignment Booklets.

Module 1: Managing Soil Resources – Overview

Soil is a basic agricultural resource. Good quality soil can produce a bountiful harvest and contribute to a successful farming operation. Poor soil produces stunted crops and results in abandoned farms. This module examines some of the methods used to manage the soil for food production.

In this module students will

- examine the characteristics that determine the overall quality of soil
- see the living things in soil that make it work
- learn some of the ways in which soil is managed to produce better crops
- discover the problems facing the soil resource, and determine how these problems can be controlled



Evaluation

The student's successful completion of all assignments in the Assignment Booklet will depend on practice obtained while doing the various activities in the Student Module Booklet. In this module students are expected to complete four section assignments.

The following distribution of marks will determine the student's grading for this module.

Section 1 Assignment	25 marks
Section 2 Assignment	25 marks
Section 3 Assignment	25 marks
Section 4 Assignment	25 marks
<hr/>	
TOTAL	100 marks

Each module for the Agriculture: Land and Life Year Two course is worth 25% of the total final grade, based on an equal weighting of the four modules in this course.

Materials Needed for Module 1

In order to assist students effectively in their study of this course, it may be helpful to preview Module 1. This will give you an idea as to how the topics are developed; it will also give you an overview of the materials needed in the module. In some cases if the materials suggested are not readily available, the learning facilitator may be able to substitute suitable materials for the student, so that the activities can be completed successfully.

Most of the materials needed for Module 1 can be obtained when students are ready to do an activity. However, some materials should be collected ahead of time so they are available as needed.

1. The following textbook is required to complete Module 1:

- *The Living Soil: A Renewable Resource – A Science Module*, by Sue Bland and Marilyn Lewry. Weigl Educational Publishers Limited, Edmonton and Regina, 1991.

This textbook is available for purchase from the Learning Resources Distributing Centre (LRDC).

2. Students will need to collect a sample of topsoil (the darkest layer near the surface) to experiment with in several activities. The topsoil should be obtained as soon as possible, so that it is available when it is needed. If it is winter and students are unable to gather a sample outside, then you may be able to obtain surplus samples from a soils laboratory at the provincial Agricultural Soils and Animal Nutrition Laboratory, Edmonton, or from another available local source, such as an agricultural office.

3. Students will require materials for testing soil acidity. You may need to assist them in getting these materials. Students may
- use litmus paper which can be obtained from a school science laboratory or a local pharmacy
 - use specially treated strips of paper contained in soil test kits available from gardening stores
 - use a pH meter, if one is available

Media

The videotape resources for this module may be available from the Alberta Distance Learning Centre, or call your local school authorities.

The following five video programs are suggested if students are to use the optional media pathways in Module 1:

- *Vegetation and the Soil*, Part 4 from the series *North America: Growth of a Continent*, VHS videotape, 15 min.
- *Soil: Understanding Our Earth*, VHS videotape, 12 min.
- *A Sense of Humus*, VHS videotape, 28 min.
- *Oh! Gully! Where is the Soil?*, VHS videotape, 22 min.
- *Gone With the Wind – Too!*, VHS videotape, 24 min.

Note: If the media resources are not available, students will still be able to complete the activities by following the module booklet or the textbook, *The Living Soil: A Renewable Resource*.

Section 1: What Is Soil?

In this section students will learn about the importance of soil for their survival and comfort. They will examine a sample of soil and find out how it is formed in nature, and how the properties help to classify soil and determine its use for agriculture.

Check and discuss the answers to the following activities with your students.

Section 1: Activity 1

1.



Use this tree to discover the importance of soil to the food, materials, and activities that you enjoy each day.

- a. On the lowest branches, write the names of plants that are grown in soil.
- b. On the next branch above, write the names of products or animals that depend on these plants.
- c. On the next branches, write the names of products, animals, or activities that depend on the branches below.
- d. Continue this process until all of the branches are filled with names.

The answers will be written on the tree branches in the Student Module Booklet. Answers will vary. This question works well as a brainstorming activity with a group of students, or the student can discuss this question with the learning facilitator or other family members.

2. What does a plant obtain from soil that it cannot get from water or the air?

Soil provides nutrients for plant growth. Without an external supply of nutrients, normal growth would be incomplete and the hydroponic plant would eventually collapse and die.

3. Could all of the world's food needs be satisfied with plants that are grown hydroponically? Explain.

People can grow plants very efficiently with hydroponics, but this is a method that depends on expensive labour and limited natural resources. It would be impossible to produce enough food to satisfy everyone's needs using this method. Then there are all of the other living things that depend on plants grown in soil – it would not be possible to produce food for all of these by hydroponics.

Students can observe the growth of a plant without soil by starting with two small plants of similar size from a gardening shop. One plant should be carefully removed from the pot and the soil carefully cleaned from the roots. This plant should then be placed in a glass of water as shown in the Student Module Booklet. A cardboard collar can be cut from a milk carton to keep the top growth above the surface of the water, and a screen of black paper can be placed around the glass to keep the roots from the light. The growth of this plant can be compared with the growth of the second plant (which is grown normally in soil) as the students work on this module.

4. How could a knowledge of soil be important to you in the future? Be creative!

Answers will vary. Students may give acceptable answers that go beyond the standard answers of soil being important for

- *growing plants which supply food and oxygen for humans and other life forms*
- *landscaping*
- *gardening*

Section 1: Activity 2

This activity will require students to obtain a sample of topsoil. You may wish to collect this sample with your student. Be sure to point out other aspects of the soil when you are there, such as the importance of roots, and a vegetation layer at the surface. Show the students a soil profile and identify the topsoil layer.

If you are unable to obtain a good soil sample, you may check at a local soils lab or local agricultural office to see if they have surplus samples. These soil samples are usually available with a complete soil analysis, which could serve as a handy answer key for some parts of this activity.

1. Describe where you obtained your soil sample.
2. Describe your soil as follows:
 - a. Colour:
 - b. Smell:
 - c. Feel:
3. Do you see living things in your sample?
4. Can you identify any remains of dead plants or animals?
5. Separate the components of your soil sample as follows (*using the method described in a. to d. in the Student Module Booklet*):
 - e. If possible, compare your soil sample with examples collected by other agriculture students. What differences can you see?

Answers to questions 1 to 5 will vary. Different soil samples will vary in colour, odour, texture, and organic content.

Students should save their soil samples for a later activity in which they will determine several important soil characteristics.

Section 1: Activity 3

Students can obtain the answers to the questions in this activity in one of three ways:

- by watching media resources about soil formation
- by reading the assigned pages in the textbook
- by reading the summary in the Module Booklet

The following videotapes are about soil formation:

- *Soil: Understanding Our Earth*
- *Vegetation and the Soil, Part 4* from the series *North America: Growth of a Continent*

1. Which of the weathering processes mentioned in the diagram are physical processes? Circle and label them with a coloured pencil.

The following are physical processes:

- *water is repeatedly frozen and thawed*
- *running water*
- *windswept sand*

2. Which of the processes are chemical or biological? Circle and label them with a second colour.

The following processes are chemical or biological:

- *It (a lichen) recovers nutrients from the rock by attacking its surface with weak acids.*
- *Water will dissolve soluble minerals and leave other minerals behind.*
- *Air and water take part in chemical reactions that break down minerals in rocks.*
- *The roots of a tree can enter small cracks and open the cracks to split rocks apart.*

Students can try the method described in “Activity 2: How Do You Weather a Rock?” on page 11 of *The Living Soil: A Renewable Resource*, or use the method described in question 3 to answer questions 3. a. to 3. d.

3. Gather several rocks and try to “weather” them using the following methods.

- a. Rub two rocks together. Did you have any success?

Breaking down rocks by abrasion is a slow and difficult process.

- b. Test for hardness by scratching each rock sample with a nail. Put your samples in order from hardest to lightest.

A nail has a hardness of about 5 on Moh’s hardness scale (1 to 10). Igneous rocks and quartzite sandstones will be harder (> 5), while carbonate rocks or shales will generally be softer (< 5).

- c. Obtain a small sample of weak five percent HCl from your science teacher. Use an eyedropper to place a few drops of acid on each sample. Fizzing and bubbling will indicate the presence of calcium carbonate, which is a mineral easily dissolved by acid solutions. How will this affect the rock?

Weak acids will dissolve calcium carbonate in limestones and other carbonate rocks, or rocks with a carbonate cement. Once part of a rock or the cementing material holding the particles together is dissolved, the remainder of the rock will be more easily eroded.

- d. Do you want proof of the power of expanding water? If so, fill a small glass jar to the top with water. Place the lid on tightly. Put the jar inside a strong plastic bag and freeze it overnight. What happened to the jar? Why did this occur?

The jar will break. This experiment provides visible proof that water expands when it is frozen.

4. Give examples of the types of organic matter that you might find in the soil.

Organic matter found in the soil may include parts of living plants (plant roots, leaves, and seeds), animals (earthworms), microorganisms (bacteria and fungi), remains of dead plants and animals, plus decomposed plants and animals (humus).

5. How is organic matter important to soil?

Organic matter

- acts as a reservoir of nutrients that can be recycled and used by plants
- provides a “glue” to bind particles of soil together and prevent erosion
- improves the ability of soil to hold moisture

6. Imagine that you are a soil scientist. By now you will have determined how soils form, and know something about the past climate in Alberta. Number the following sequence of events in chronological order to describe how soil has formed in this province.

- 8 The rich prairie topsoil supports grasslands and agriculture.
- 2 The climate gradually warms until the last great glacier melts about 10 000 years ago.
- 6 Tiny microorganisms in the soil decompose organic matter to release nutrients and enrich the soil.
- 3 or 4 Water enters cracks in the rocks and expands as it freezes. A repetition of this process over many years causes the rocks to break into smaller and smaller pieces.
- 5 The climate continues to warm up. Grasses and trees replace Arctic vegetation.
- 1 Great continental glaciers scour the northern parts of North America. Rocks and mineral matter become mixed into the ice as the glaciers move forward.
- 3 or 4 Hardy vegetation, such as lichens and mosses, grow in a climate much like the present-day Arctic climate. Acids produced by this vegetation etch the surface of the rocks.
- 7 Much of the vegetation cover dies every season. The remains of plants and animals accumulate in the soil.

7. The terms topsoil, subsoil, and parent material describe the three main soil horizons. In your text, these zones have been identified as A-horizon, B-horizon, and C-horizon. Add these letters to the soil profile, beside the zones where they apply.

Topsoil – A-horizon

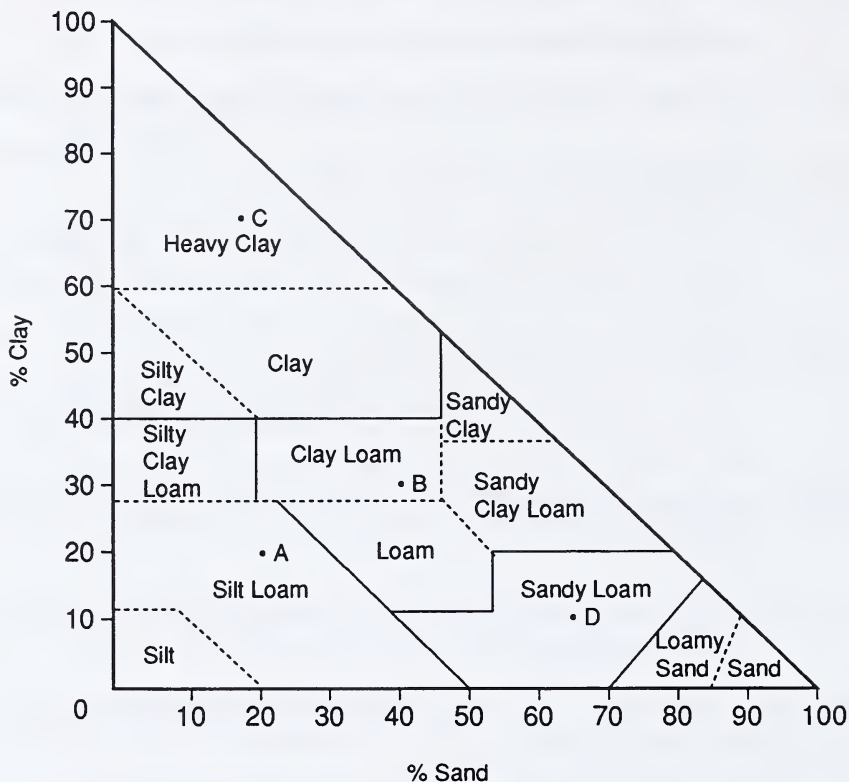
Subsoil – B-horizon

Parent Material – C-horizon

8. The root zone is the normal depth from which roots recover water and nutrients. Which soil horizons does this zone usually represent?

The root zone usually represents the A- and B-horizons.

Section 1: Activity 4



1. Use the soil texture triangle to help you fill in the blanks in the following table. Plot these samples on the chart. Sample A has been done for you as an example.

Sample	Sand	Silt	Clay	Texture
A	20	60	20	silty loam
B	40	30	30	clay loam
C	15	15	70	heavy clay
D	60	30	10	sandy loam

¹ Alberta Agriculture for the chart from *Alberta Soils Course*. Reprinted by permission of Home Studies Section, Education Branch, Alberta Agriculture.

2. Describe the texture of your own soil sample by feel, using the method in the following chart. Find the starting point on the chart and follow the instructions carefully until the choices lead to a texture description for your soil.

- The texture description of my soil is _____.

Answers will vary. Use the method described in the Student Module Booklet to determine texture.

3. Describe the soil structures that are best for farming.

Granular soil structures are best for seed germination, root penetration, and drainage, while blocky or platy structures can slow both root penetration and the downward movement of water.

4. What type of farm operations may damage soil structure? In what way?

Heavy farm equipment may compact soil and produce platy structures. Too much tillage can pulverize soil aggregates.

5. Based on the previous graph, how does the amount of clay affect a soil's ability to hold water?

Clay increases a soil's ability to hold moisture.

6. Examine the organic matter bar graph. Describe how the amount of organic matter in soil affects its ability to hold moisture.

Soils with high organic matter content can hold more moisture than soils with less organic matter.

Section 1: Activity 5

The information that students obtain in answering the questions in this activity will be needed in order for them to answer question 4 of Section 1 in the Module 1 Assignment Booklet. As the learning facilitator, you should be available to help the students obtain the necessary materials, to help with the various procedures described in this activity, and to provide feedback for their responses. By carrying out the various procedures in this activity, students should become familiar with some of the tests that are available in determining the characteristics most often used to describe soil.

1. Write down the colour of your soil, and estimate the amount of organic matter that it contains.

Answers will vary but should be within the limits described in the chart preceding this question in the Student Module Booklet. If an alternate explanation is offered, check to see that it is appropriate.

Have students omit the Extension Activity mentioned on page 33 of the Student Module Booklet, as the part on measuring the exact percentage of organic matter is not included as part of “Activity 3: How Can Soils Be Compared?” on pages 16 and 17 of *The Living Soil: A Renewable Resource* in the current edition of this textbook.

2. What is the textural description of your soil sample? If you are using a different soil sample than in the previous activity, determine the textural description of your new sample by feel, using the method described in the previous activity.

Texture name: _____.

Answers will vary, according to the proportions of sand, silt, and clay particles the students' soil samples contain. Check to see that the students arrived at their answers by using the method described in Activity 4 under “Determining Soil Texture by Feel.”

3. Use this texture description, and the soil texture triangle, to estimate the proportion of sand, silt, and clay in your sample.

Sand _____ (%)

Silt _____ (%)

Clay _____ (%)

Answers will vary. Check percentages with the texture triangle in Activity 4.

4. • volume of soil that fills the pot _____
- total volume of water added to the bowl _____
- volume of water that remained in the first bowl _____
- volume of water that drained from the flower pot _____

Answers will vary. The results stated here will be used to determine the answers to questions 5 to 8.

5. The porosity of a soil is the total amount of water absorbed by the soil in the flower pot. To calculate this you need to subtract the volume of water that remains in the bowl after the flower pot was removed from the bowl, from the total volume of water that was added to the bowl. Calculate how much water was lost from the first bowl when the flower pot was removed. (This gives you the total amount of water that was absorbed by the soil in the flower pot.)

Answers will vary. Check to see that the student used the values from question 4 (total volume of water added to the bowl minus the volume of water that remained in the first bowl) to arrive at an answer.

6. The porosity of a soil is usually expressed as a percentage. To determine the porosity of your soil sample as a percentage, you need to divide the amount of water absorbed by the soil in the flower pot by the volume of soil that was used to fill the flower pot, then multiply the result by 100. Calculate the porosity of your soil sample as a percentage.

Porosity =

Answers should be in the area of 25%. If the answer varies greatly from this percentage, check to see that the student followed the correct procedure to arrive at the results to question 4.

7. Field capacity is the amount of water remaining in the soil after excess water has drained away. To determine the field capacity of your soil sample subtract the amount of water that drained into the second bowl from the total amount of water absorbed by the soil in the flower pot. Calculate how much water remained in your soil sample after the excess water has drained away.

Answers will vary. Check to see that the student subtracted the volume of water that drained from the flower pot (part of question 4) from the answer that was obtained for question 5 in order to arrive at the answer for this question.

8. Field capacity is usually expressed as a percentage. To determine the field capacity of your soil sample as a percentage, you need to divide the amount of water that remained in your soil sample by the volume of soil that was used to fill the flower pot, then multiply the result by 100. Calculate the field capacity of your soil sample as a percentage.

Field capacity =

Answers should be 5 to 10% below porosity.

9. Why is field capacity an important soil characteristic?

Field capacity indicates how much water is available for plants, and tells how well the soil drains.

Students will require materials for testing the pH of their soil sample in order to answer question 10 and the Extension Activity, if they choose to do so. To test the pH of their soil sample, students may

- use litmus paper which can be obtained from a school science lab or a local pharmacy
- use specially treated strips of paper contained in soil test kits available from gardening stores
- use a pH meter, if one is available

10. Find the pH of your soil sample. Describe how you conducted the test.

Answers will vary. The range of soil pH for agricultural soils in Alberta is usually between 5.0 and 8.5. If the student answer seems unreasonable, you might suggest that the student repeat the pH test or use an alternate method of testing, if this is possible.

Extension Activity: Collect several different soil samples to complete the following chart. Make a solution with these samples and test for pH. Record the pH values that you obtain in the following chart.

Sample	Collected From	Colour	Texture	pH

Not all students will do the Extension Activity. For those who do, the comments made in the answer to question 10 will apply.

11. Describe how a knowledge of soil pH might be used to help you grow a better crop.

A knowledge of soil pH will help you select the right crop for the soil condition. You may also be able to determine if lime should be added to improve the pH of the soil.

When this activity is completed to their satisfaction, students may record the answers in their Assignment Booklet under question 4 of the Section 1 Assignment.

Section 1: Activity 6

1. Which soil order is most important for agriculture on the prairies?

Chernozemic soils are most important.

2. What is the main type of natural vegetation found in each of the areas just shown?

- *Foothills – aspen and evergreen forests, lodgepole pines*
- *Boreal Forest – coniferous (evergreen) trees, poplars*
- *Parkland – aspen trees, grasses, or crops*
- *Prairie – native grasses or cultivated grasses*

3. Which soil zones are best for cultivation (farming)? Why?

The black and dark brown soils are best for farming, because they are rich and fertile. They normally contain enough moisture to grow a wide variety of plants. Brown soils can also be used if the land is irrigated.

4. Which soil zone might be best for grazing livestock? Why?

Soil in the brown soil zone is fertile but lacks moisture. The grass cover protects it from erosion. This land is often used for grazing livestock.

5. Which zone is not suited for agriculture? Why?

Heavily forested areas are generally not suited for agriculture because they are usually very acidic, have low organic matter, and few nutrients in the topsoil. Parts of the brown soil zone are also unsuitable, due to a lack of moisture.

6. Which soil zone is the most abundant in Alberta?

Luvisolic soils or grey forested soils are the most common type of soil in Alberta. These soils lie under about 60% of the province's land area.

7. The distribution of soil zones and vegetation cover on the prairies is shown on two separate maps in your textbook, in the "Soils on the Prairies" section, starting on page 22.

- a. What soil is usually found under forested areas?

Luvisolic soils are usually found in grey forest soil zones.

- b. What soil zone is associated with parkland vegetation?

The black soil zone is related to parkland vegetation.

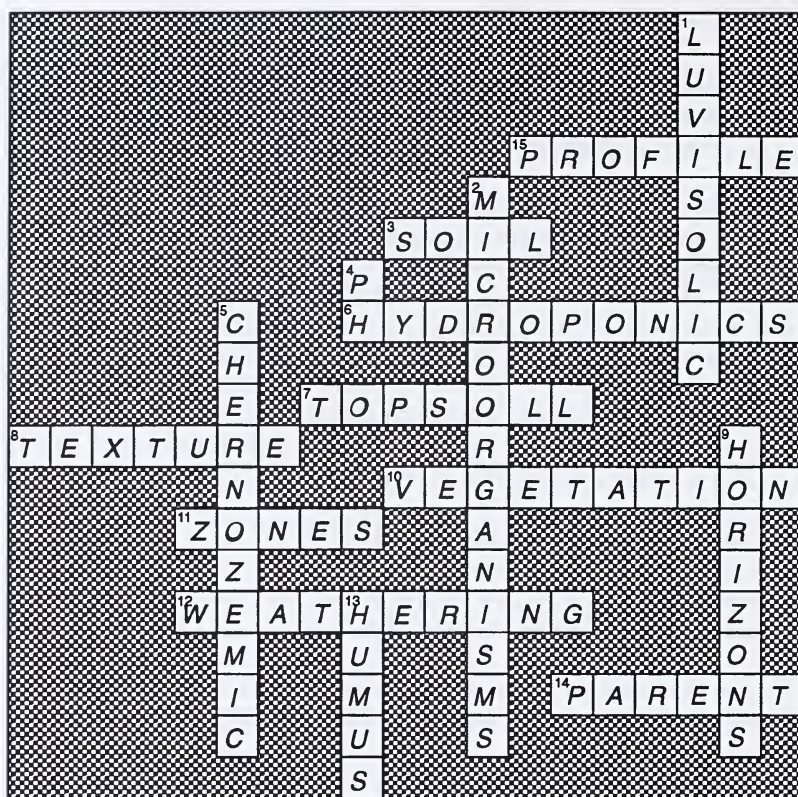
- c. What soil zone covers much of the southern prairies? What kinds of climate and vegetation created this type of soil?

The brown soil zone is found over much of the southern prairies. This type of soil is formed below hardy grasses that grow in very dry conditions.

Section 1: Follow-Up Activities

Extra Help

This section contains many new words that will be used throughout this module. Complete the following crossword puzzle to review the new vocabulary.



Down Clues

1. A soil order which forms below forested areas.
2. The living things that decompose organic matter in the soil.
4. This is a measure of acidity or alkalinity.
5. This is a soil order which forms below grass-covered areas.
9. These are the layers in the soil profile.
13. This is made from decomposed organic matter.

Across Clues

3. The materials covering the surface of the earth in which plants grow.
6. Growing plants without soil.
7. The organic layer of the soil profile.
8. This is used to describe soil based on the sizes of mineral particles.
10. This is necessary for the formation of soil.
11. The term applied to geographic areas that contain soils with similar soil profiles, and therefore similar conditions of formation.
12. The breakdown of rocks and minerals.
14. The material on which a soil forms.
15. The sequence of layers seen in soil.

Enrichment

Explain why most of the major cities in Alberta are located on the best farming land.

When the land was settled by Europeans, the best land was occupied first. These areas soon became development centres for the surrounding farmland, and towns developed. Continued growth swallowed up more and more land.

Note: The student should now complete the assignment for Section 1 in the Module 1 Assignment Booklet.

Section 2: What Happens in the Soil?

This section explores the interactions between soil and living things, and examines the recycling of nutrients in the soil.

Check and discuss the answers to the following activities with your students.

Section 2: Activity 1

1. Describe how plant roots contribute to the survival of land plants.

Roots anchor plants to prevent them from being washed away when it rains, or from toppling over in high winds. Roots also provide a means to obtain moisture and nutrients from the soil.

2. Describe how plant roots help the soil.

Plant roots bind soil particles together to provide structure for the soil, and to help prevent erosion. Tree roots can break up large rocks – this contributes mineral matter to the soil. When the plant dies, the roots add organic matter as well.

Students can observe an example of how osmosis works by placing dried fruit into a glass of water and observing the changes that occur.

3. What will happen to the fruit?

The fruit will expand as water enters it.

As an Extension Activity students can investigate the process of osmosis further by completing “Activity 6: How Can Minerals Affect Plant Growth?” on page 33 of *The Living Soil: A Renewable Resource*.

4. List the visible organisms found in soil.

Burrowing animals such as moles, gophers, and badgers are found in soil, as are smaller organisms like earthworms, roundworms, insects, spiders, slugs, and centipedes.

5. How do the activities of these organisms help the soil?

Burrowing organisms are soil builders – they mix and aerate soil as they dig. Even smaller organisms such as ants can mix soil. The elimination of body wastes from these organisms is a source of organic matter that provides a readily available supply of nutrients.

6. Why are some of these organisms not appreciated by farmers?

They create mounds and holes in fields, or consume part of the crop.

7. What two types of microorganisms decompose organic matter in the soil? Give one example of each kind.

Fungi (yeasts, mildew, moulds, and mushrooms) and bacteria (actinomycetes) decompose organic matter in the soil.

8. How do microorganisms help improve the soil?

Soil microorganisms, such as bacteria and fungi, help improve the soil by decomposing organic matter, which recycles the nutrients removed for plant growth back into the soil. Decomposition also produces humus, a gummy substance that binds soil particles.

As an Extension Activity students can observe the effects of decomposition and see how fast this happens to various materials in the soil by completing “Activity 8: How Does Soil Recycle Organic Matter?” on pages 42 and 43 of *The Living Soil: A Renewable Resource*.

9. Explain how producers, consumers, and decomposers interact within an ecosystem.

Producers, consumers, and decomposers form a cycle within an ecosystem. The producers are green plants which make food for other organisms. Consumers use the plants, or other animals, for food. Eventually plants and animals die and provide food for the decomposers. The resulting nutrients are then available for new plant growth.

10. Which animals in this food web would compete with humans for the use of the land? How?

Mice, rabbits, and grasshoppers compete with humans for the use of the land by eating the field crops that farmers are trying to grow.

11. Which animals would humans find beneficial in this food web? How?

Foxes and insect-eating birds would help humans by keeping harmful creatures under control.

12. What is removed from the soil by plants?

Nutrients are removed from the soil by plants.

13. How are nutrients returned to the soil when the land is farmed?

Nutrients are returned to the soil by returning crop residue (straw) from crops, and animal manure back to the soil. Nutrients are also returned to the soil by the use of commercial fertilizers.

14. How are nutrients returned to the soil in nature?

Animals return the food they eat back to the soil in the form of manure, and living things return nutrients to the soil when they die.

15. The grasses which once covered the prairies protected and enriched the soil with their remains. What protects the soil now?

Crops offer a similar kind of protection to what the grasses once did. Dangers arise when the crops are harvested and the soil is laid bare, or when the crops are unable to withstand harsh conditions (such as low moisture) that grasses are better adapted to handle.

Section 2: Activity 2

1. What is the difference between a macronutrient and a micronutrient?

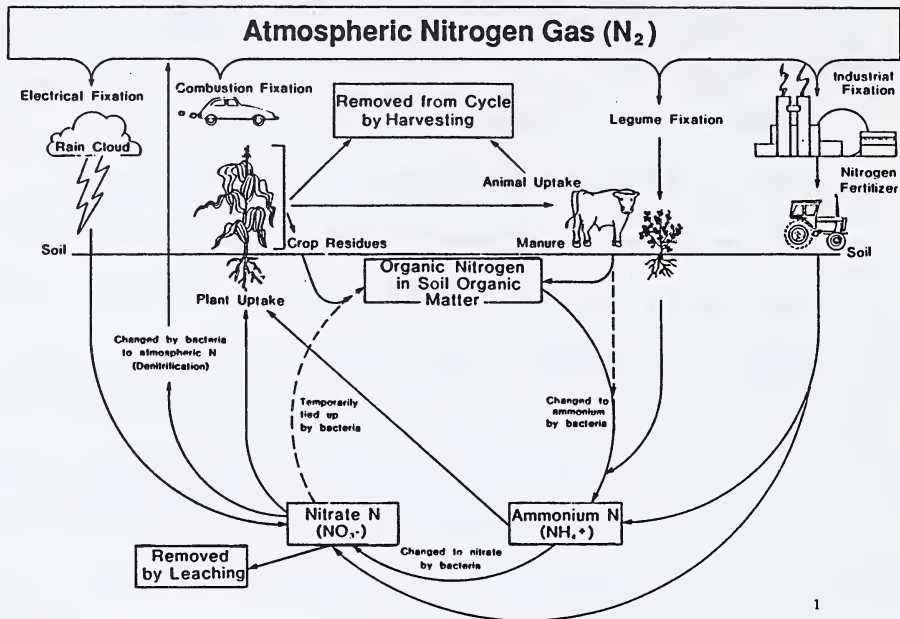
Macronutrients are needed in large quantities, while micronutrients are required in smaller amounts.

2. Name the nine macronutrients that plants require.

carbon
oxygen
sulphur

hydrogen
potassium
magnesium

nitrogen
phosphorus
calcium



3. On the nitrogen cycle diagram, highlight the ways in which nitrogen is taken from the soil. Then list (in the following space) all the ways in which nitrogen is added to the soil to replace what has been lost.

On the diagram students should highlight that the nitrogen is removed from the soil by plant uptake. Nitrogen is lost when crops are harvested as food for plants or livestock. Some nitrogen in the soil is also changed to atmospheric nitrogen.

Nitrogen is added to the soil by the following:

- legume fixation
- industrial fixation (commercial nitrogen fertilizers)
- bacterial fixation from organic matter (manure and crop residues)
- combustion fixation
- electrical fixation

¹ Alberta Agriculture for the chart from *Alberta Soils Course*. Reprinted by permission of Home Studies Section, Education Branch, Alberta Agriculture.

4. What would happen to the amount of nitrogen in the soil where legume crops are growing?

The amount of nitrogen would increase.

5. What would happen to the amount of nitrogen in the soil if a non-legume crop were harvested on the same field for several years?

The amount of nitrogen would decrease.

6. What would happen to the amount of nitrogen in the soil if soil bacteria were destroyed by chemicals?

The amount of nitrogen available for plant use in the soil would decrease. Soil bacteria are needed to change nitrogen gas in the soil into a form plants can use.

7. How could this method help the farmer, the plants, and the environment at the same time?

The farmer would save the cost of fertilizer since smaller amounts would be required. Plants would be able to use more of the available phosphorus, and the environment would be helped as the organic matter in the soil would be decomposed and the nutrients would be released for plant growth.

8. How might legumes be used to reduce the amount of nitrogen fertilizer required to grow a non-legume field crop such as wheat?

If a legume crop is planted every few years, it can replenish the nitrogen removed by a non-legume crop.

Section 2: Follow-Up Activities

Extra Help

1. Fill in the blanks in the following table to identify the main producers, consumers, and decomposers in the soil ecosystem.

	Example	What Is Consumed or Produced?
producer	plants	Food is produced.
consumer	animals or people	Plant and animal matter is consumed by people. Other animals are consumed by carnivores. Plants are consumed by herbivores.
decomposer	microorganisms	Dead plants and animal bodies are consumed to release nutrients.

2. Write the following words either to the left or right of the middle line to show how a balance can be achieved in the soil on a farm.

fertilizer

harvesting crops

plant material

plant nutrients

fertilizer

plant material

fungi and bacteria

animal wastes

+

additions to the soil

fungi and bacteria

soil erosion

livestock feeds

animal wastes

plant nutrients

harvesting crops

livestock feeds

soil erosion

-

subtractions from the soil

Enrichment**Enrichment A**

In what ways do earthworms help to keep soil fertile?

Earthworms help to keep soil fertile by

- *digesting and decomposing organic matter*
- *adding animal wastes to the soil for further decomposing*
- *mixing and aerating the soil*

Enrichment B

Even a seemingly barren soil sample will provide evidence of life.

Complete “Activity 5: Is the Soil Alive?”, on pages 28 and 29 of the textbook, to see this evidence for yourself.

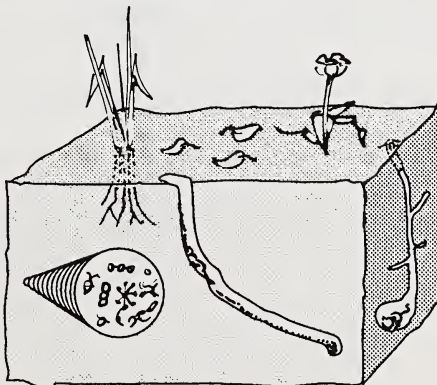
What type of organisms did you find? Describe the evidence that you see.

Algae and bacteria were the types of organisms found. Algae will form a film on the microscope slide, and bacteria will etch the surface of the 35 mm slide.

Enrichment C

Complete “Activity 7: How Can Soil Organisms be Collected?”, on page 35 of the textbook. Then draw what you see in the following space. Be sure to outline the scale of magnification below your diagrams.

Here are some of the organisms that students might see.



Note: The student should now complete the assignment for Section 2 in the Module 1 Assignment Booklet.

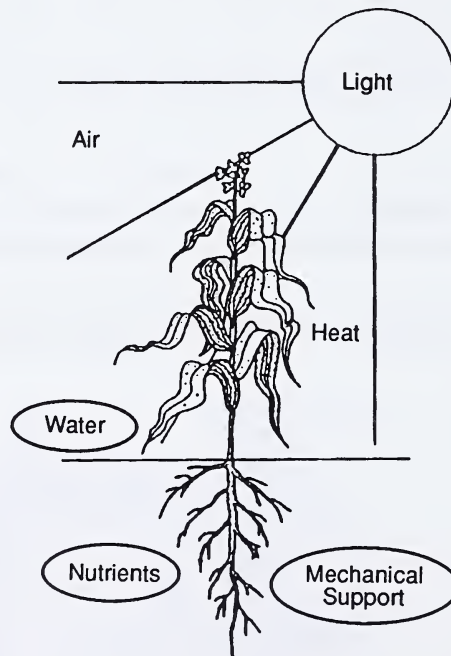
Section 3: Managing Soil for Production

In this section students will examine how soil satisfies plant needs, learn about farm operations that affect the soil, compare different methods used for soil tillage, learn the causes and controls of soil erosion, and see how farmers manage soil nutrients to maximize production.

Check and discuss the answers to the following activities with your students.

Section 3: Activity 1

1. This diagram of a corn plant shows the basic needs of a plant. Circle the basic needs that are satisfied by the soil.



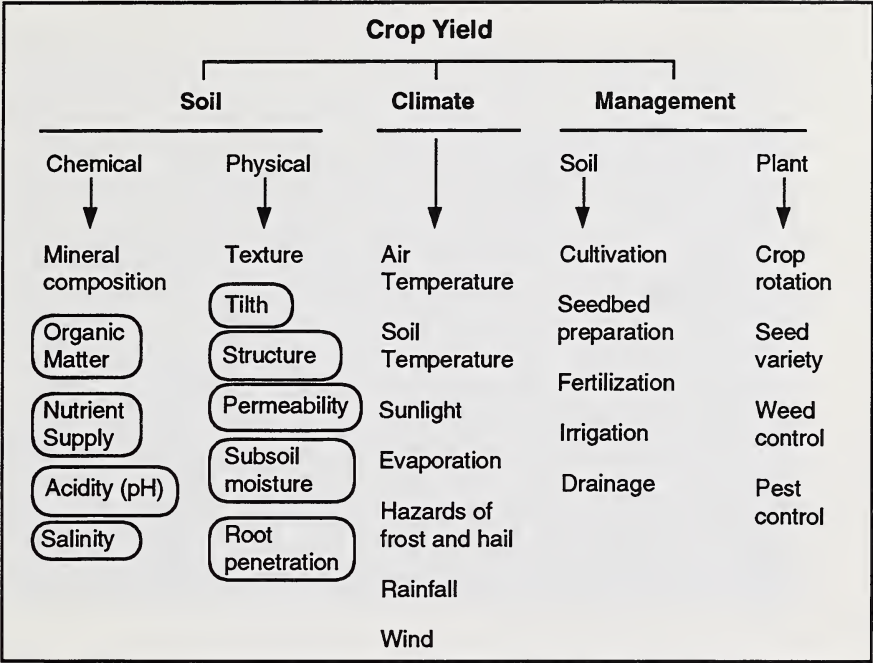
1

¹ Alberta Agriculture for the graphic from *Alberta Soils Course*. Reprinted by permission of the Home Studies Section, Education Branch, Alberta Agriculture.

2. List the limiting factors that are determined by the soil condition.

A lack of moisture and nutrients, and a poor soil structure are limiting factors.

3. Circle all of the soil factors that a farmer or gardener might control.



The factors that are circled can be controlled by the ways listed under Management. Mineral composition and texture are more difficult to control but they too can be changed over time by such management practices as cultivation, irrigation, fertilization, and crop rotation.

4. What are the four reasons why conventional tillage is used on a farm?

Four reasons for conventional tillage are the following:

- seedbed preparation
- weed control
- management of crop residues
- moisture conservation

¹ Alberta Agriculture for the graphic from *Alberta Soils Course*. Adapted by permission of the Home Studies Section, Education Branch, Alberta Agriculture.

5. What are the main uses of tillage during

a. Spring?

Weed control and seedbed preparation are the main uses of tillage during spring.

b. Summer?

A summer use for tillage is weed control.

c. Fall?

Managing crop residue and moisture are main fall uses for tillage.

6. How might summerfallowing reduce a farmer's expenses and increase his or her income?

Summerfallowing means the following:

- *There is a lower cost to fertilize summerfallow fields.*
- *There are no seed costs in the fallow year.*
- *Insects and weeds are eliminated without expensive chemical sprays.*
- *The moisture conserved should result in a better crop in the following year.*

7. Summerfallowing may have economic benefits for some areas, but it also has costs. List costs to both the farmer and the soil.

Summerfallowing costs include

- *an increased risk of soil erosion*
- *a loss of valuable organic matter and nutrients to soil erosion*
- *no income in the fallow year*
- *increased tillage costs*

8. There are many questions that a farmer should answer before considering summerfallow. Can you think of some important questions?

Farmers should consider these questions before summerfallowing:

- *Is this method suited for the climate and soil?*
- *Will the savings be worthwhile?*
- *Is there a potential for soil erosion?*
- *Will moisture savings be significant?*
- *Will yields really increase significantly?*

Section 3: Activity 2

1. How does soil erosion differ from natural erosion?

Soil erosion happens very quickly, is damaging to the environment, and is affected by human activities. Natural erosion occurs slowly and without the influence of human activity.



1

2. Can you explain how the rocks in this picture came to sit on the surface of the soil?

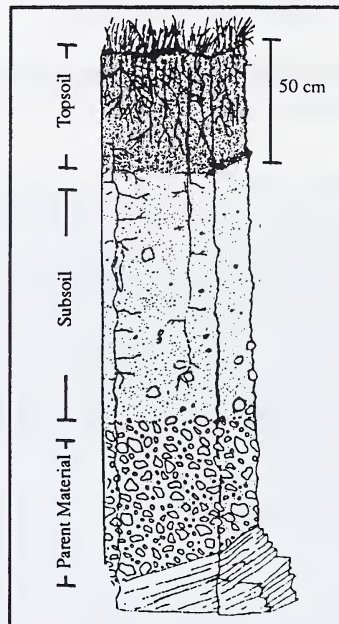
The soil around the rocks has been eroded.

3. Which parts of the soil are eroded? How does this affect the soil?

The small clay particles and light organic matter are eroded first. This affects the soil's fertility, its ability to resist further erosion, and its ability to retain water.

¹ Alberta Agriculture for the photograph. Reprinted by permission of Conservation and Development Branch, Alberta Agriculture.

4. Consider the following soil profile to answer the following questions.



- a. How long would it take to form the topsoil shown in the soil profile diagram if five centimetres of soil forms every 100 years?

It would take 1000 years to form the topsoil.

- b. Suppose that soil is slowly eroding from hilltops on a farm. If one centimetre is lost every year, how long will it take until there is no topsoil left?

It will take between 50 to 55 years. Don't forget that new topsoil is forming at the same time.

- c. What would be an acceptable rate of erosion so that no topsoil is lost?

The rate of erosion should be the same or less than the rate of soil formation, or about five centimetres every 100 years.

Students can obtain the answers to questions 5 to 8 in one of two ways:

- **by watching videotapes to learn about soil erosion and how it can be controlled**
- **by reading information in the Student Module Booklet about the methods used to prevent soil erosion**

The following videotapes are about controlling soil erosion:

- *Gone with the Wind – Too!*
- *Oh! Gully! Where is the Soil?*

5. How can plants be used to protect the soil from erosion?

Trees can create shelterbelts, strips of crops can trap moving soil, and grasses or crops can cover the soil.

6. How does crop residue help control soil erosion?

Crop residue provides a protective cover for the soil, and adds organic matter to help the soil hold moisture and resist erosion. The residue eventually breaks down to form humus, which acts as a glue to hold soil particles together.

7. Tilling should be avoided when the soil is dry. Why?

Dry soil is more easily eroded, especially when it is disturbed by tillage, which also increases evaporation losses by bringing moist soil to the surface.

8. Suppose you are a farmer considering a switch from conventional tillage methods to zero tillage. Compare the advantages and disadvantages of a change to zero tillage.

Advantages

- *little soil erosion*
- *lower fuel costs due to fewer tillage operations*

Disadvantages

- *heavier equipment required*
- *equipment is more costly*
- *more herbicides required*
- *weed control is less effective*

Section 3: Activity 3

1. How much of each nutrient is present in a fertilizer with the number (16-20-0-14)?

Nitrogen: 16%

Phosphate: 20%

Potash: 0%

Sulphur: 14%

2. What are the advantages of placing fertilizer and seeds into the ground in one operation?

Putting fertilizer and seeds into the ground at the same time is useful, due to the following:

- *It is efficient – it saves time, energy, and labour.*
- *The fertilizer is placed where it can be easily obtained by the plant.*

3. If manure is a low-quality source of plant nutrients, why is it still considered a good fertilizer?

The true value of manure lies in its ability to replace lost organic matter in the soil, and to serve as a supply of nutrients as it slowly decomposes. If done properly, the application of manure to the soil is an environmentally sound method of disposal.

4. How can soil testing help the Jones' farm?

Soil tests outline the type and amount of fertilizer to apply. Tests can also indicate other soil problems that may affect productivity, such as acidic, alkaline, or saline conditions, or poor structure. Testing the soil can prevent an unnecessary use of fertilizer, and point the way to other measures that may produce a better crop.

5. Does the use of fertilizer pay? Please show your calculations for 5. a. and 5. b. in the allotted space.

- a. Mr. Jones plans to use a nitrogen fertilizer for the barley crop. Mrs. Jones has calculated that it will cost \$18/acre for this fertilizer. The field should produce an extra 20 bushels/acre. If they receive \$2/bushel for the extra grain, will this pay for the fertilizer? How much would their earnings increase on each acre?

<i>Increased income per acre = 20 × \$2 =</i>	<i>\$ 40</i>
<i>less cost of fertilizer</i>	<i>\$ 18</i>
<i>equals increased earnings per acre</i>	<i>\$ 22</i>

- b. What would their added earnings be if the barley price dropped to \$1/bushel.

<i>Value of increased production</i>	$20 \times \$1 =$	\$ 20
<i>less cost of fertilizer</i>		\$ 18
<i>equals increased earnings per acre</i>		\$ 2

In this case the Jones' stand to make only \$2 per acre. This may not be enough to make an application of fertilizer worthwhile.

6. What are two factors that determine whether a farmer should apply fertilizer to a crop?

Two factors are the following:

- Soil test results – Is the soil deficient in one or more nutrients?*
 - Economic factors – Will it be profitable to apply fertilizer?*
7. Referring back to Section 2: Activity 2 of this module, do you remember what a legume crop is? How would these plants help the soil if they were cultivated every third year of a three-year crop rotation?

Legumes are plants such as peas, beans, and clover that have nodules on their roots which contain nitrogen-fixing bacteria. Legumes add nitrogen to the soil through their interaction with soil bacteria, and they add organic matter if they are tilled into the soil instead of being harvested. This enriches the soil so that other field crops can grow better in the other years of the crop rotation cycle.

Follow-Up Activities

Extra Help

Complete the following by filling in the blanks with the correct words from this section.

Plants have several needs which can be satisfied by the soil. These include *moisture*, *nutrients*, and *mechanical support*. If these needs are not met, they will limit plant growth. Because of this they are called *limiting factors*.

Tillage is the mechanical mixing of the soil. It is a large part of farming and is used for *seedbed* preparation, *weed* control, managing crop *residues*, and *moisture* conservation.

Summerfallow (an unseeded field) is a method used to conserve moisture in the soil from the previous season so that a better crop can be grown. This method requires a lot of *tillage* to control weeds. Over many years, this practice has resulted in a reduction of *organic matter* in the soil. Loss of the vegetation cover and less organic matter increases the risk of *soil erosion*.

Soil erosion is the removal of topsoil by *wind* and *water*. Soil can be sheltered from the direct force of the wind with shelterbelts. Moving soil can be trapped using strip farming methods. Soil can be protected by covering it with *grass*, *crops*, or *crop residue*.

Conservation tillage includes the many ways that farmers can till their land for soil *conservation*. In general, this practice means leaving a cover of *vegetation* on the soil, using less *tillage*, shallow *depths*, and slower *speeds*.

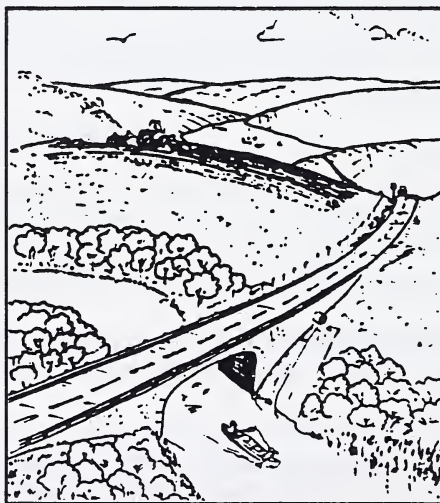
Tilling when the soil is *dry* should also be avoided. With *zero* tillage, some farmers plant and harvest a crop with no tillage at all. Specially designed seeders plant the seeds through the stubble of the previous year's crop.

When a particular nutrient is in short supply, it is said to be *deficient*. A *fertilizer* is any substance which contains plant nutrients and can be added to the soil to encourage plant growth. If soil testing suggests that nutrients are in short supply, two types of fertilizer may be applied: *organic* fertilizers and *chemical* fertilizers.

Changing the crops grown on a field can have benefits for the *soil*. This is called *crop rotation*. This method may reduce the potential for erosion and add organic matter to the soil. Sweet clover or legumes that are grown, but not harvested, become green *manure*.

Enrichment

Enrichment A



After examining the previous illustration, make a list of all the places where eroded soil may go.

Soil that is removed from the land can go anywhere. Winds may carry it hundreds of kilometres. It can blow into woodlands, a neighbour's field, or collect in a roadside ditch. Runoff water deposits soil in lakes, ponds, streams and low spots on the land. Streams and rivers carry soil to lakes or to the sea. If it can be done at all, reclaiming soil is an expensive process.

¹ Alberta Agriculture for the graphic from *Conserving Soil for a New Generation*. Reprinted by permission of Soil and Water Conservation Branch, Alberta Agriculture.

Enrichment B

Look for information on composting. Come up with a design for your own composter. Describe how you will maintain the pile, and what you will do with the “fertilizer” that you make.

This is a project that may be started in the winter but will progress best during the summer. Have your students research and prepare a design for their pile. Answers will vary.

Note: The student should now complete the assignment for Section 3 in the Module 1 Assignment Booklet.

Section 4: Conserving Soil for the Future

In this section students will investigate the resources necessary for food production. They will also learn how the soil resource can be degraded on the prairies and around the world. Students will consider the meaning of sustainable agriculture, and investigate alternative farming practices.

Check and discuss the answers to the following activities with your students.

Section 4: Activity 1

- 1. List several of the renewable and non-renewable resources mentioned in your textbook that a farmer requires to produce food.

Non-renewable Resources	Renewable Resources
<i>oil (for fuel)</i>	<i>water</i>
<i>natural gas</i>	<i>soil</i>
<i>coal (for power)</i>	<i>air</i>
<i>phosphorus (Although they are not mentioned in the textbook, phosphorus and other minerals are needed for plant growth.)</i>	<i>solar energy (Although it is not mentioned in the textbook, solar energy is necessary for plant growth.)</i>

2. Explain why the conservation of renewable and non-renewable resources is important.

There is a limited supply of non-renewable resources. Even renewable resources can be lost if they are not maintained.

3. How did the settling of the prairies by large numbers of farmers affect the natural prairie ecosystem?

Prairie soils are not as fertile as they once were because natural plant cover has been ploughed up. Ploughing exposed the topsoil to wind and water erosion. The growth of new crops decreased the organic content of the soil as more nutrients were taken from the soil than were returned to it. Also, some of the most fertile soils are no longer used for farming – towns and cities are located on these soils.

4. Where could people grow their food if not in the soil? What is the main problem with alternative methods?

Food from the sea or hydroponic growing methods are possible suggestions, but these methods are limited in the amount of food that they can ultimately produce. Hydroponics is also costly, energy dependent, and labour intensive. However, both methods will provide welcome additions in the future.

5. List several land use or farming practices that can degrade the soil.

Soil can be degraded by the following land uses or farming practices:

- building housing subdivisions, acreages, shopping centres, and roads
- soil erosion can remove topsoil
- the salinization of the soil
- the loss of soil nutrients

6. Why is it important to increase the productivity of poorer soils?

These soils will be needed to feed the growing population of the world, and to replace agricultural land that is permanently lost to other uses.

Section 4: Activity 2

1. Can you guess what is the most effective soil erosion control?

Maintaining a cover of vegetation to protect the soil is the most effective soil erosion control.

2. Suppose lime costs are \$30/tonne and each hectare of land requires five tonnes. An application of lime can last ten years and increase the crop yield by 25 bushels per hectare. If the crop is worth \$3 per bushel, how long will it take to pay for the lime? Use the following space to show your calculations.

The cost of lime per hectare = $\$30 \times 5 = \150 per hectare.

Extra income each year per hectare = $25 \times \$3 = \75 per hectare.

The time required to pay back the cost of lime is $150 \div 75 = 2$ years.

3. Why might farmers be unable to use lime on their acidic soils? Suggest several reasons.

Lime may not be available or it may be too expensive to transport and apply to the soil in the proper quantities. Applying large amounts of lime (such as five tonnes per hectare) would require special equipment.

4. a. What type of fertilizer is used in Canada?

Commercial fertilizers are readily available and widely used in Canada, although organic fertilizers (manure) are also used when they are available.

- b. What type of fertilizer is used in a non-industrial country?

Organic fertilizers, which are low in available nutrients, are more common in non-industrial countries.

- c. What country has the most productive fields?

Agricultural land in Canada is among the most productive in the world.

5. Why is the prevention of soil salinity important?

Soil salinity reduces a farmer's income by making his or her land less productive, and it threatens the food supply by making the land unproductive. Rehabilitating the land is a costly process.

6. How might this situation be considered a serious threat to food production?

Urbanization reduces the amount of land available for food production, and it also consumes the best land. Food must then be grown on poorer land.

7. How is deforestation similar to other causes of soil erosion?

The removal of the vegetation cover has left the soil unprotected.

8. Why is it important to protect the soil from chemical pollution?

Soil needs to be protected because it is where people grow their food. Birth defects and increased cancer rates are reported in countries like Poland, where uncontrolled industrial pollution has seriously contaminated the soil. The soil provides food for many organisms that are part of the food chain.

9. What are the common causes of desertification around the world?

Drought, wind erosion, and overgrazing are causes of desertification.

Section 4: Activity 3

1. a. Do the comments you just read seem like a sustainable system of production?

Answers will vary. There is no single answer.

- b. Why or why not?

As long as there are natural resources such as fertilizer and lime, the land can continue to produce indefinitely. However, if these resources are in short supply, the condition of the land will rapidly deteriorate. Problems not related to such things as climate may be overcome.

Students can obtain the answers to questions 2 to 7 by one or both of the following methods. They can

- view the videotape *A Sense of Humus* to see how several farmers have embraced a different style of farming. Students should be aware that this is a controversial film because some of the claims made by organic farmers are difficult to prove or disprove. If students view this video, they should try to see if they agree or disagree with some of the claims made by the farmers.
- read “Case Study: Organic Farming” which starts on page 58 of *The Living Soil: A Renewable Resource*.

2. What types of plant and animal materials can act as nitrogen fertilizer?

Animal manure and plant residue break down to release nitrogen into the soil. Legume crops such as peas, clover, alfalfa, and beans add nitrogen to the soil.

3. How can some weed pests be controlled without the use of pesticides?

Plants such as fall rye, oats, rye, peas, and sunflowers discourage the growth of certain weeds. By cultivating the soil, early weed growth is encouraged. These weeds are then removed by tilling the soil again just prior to planting the seed later than most conventional farmers.

4. Can you think of some of the problems associated with these methods?

Problems include the following:

- *These methods are not geared to high levels of productivity, and require a lot of labour.*
- *Much management time is required.*
- *Results are not predictable since the nutrient content of fertilizer is difficult to predict.*
- *Pest control may be less successful without chemicals.*

5. Is organic farming more sustainable than conventional (monoculture) farming?

The common perception is yes, because organic farming uses fewer non-renewable resources. However, organic matter is a low-quality fertilizer that cannot support high levels of productivity. Without replacing the nutrients that are removed by crops, the quality of the soil will suffer. Also, more tillage is needed to control weeds – this leaves the soil more open to erosion.

6. Answer **true** or **false** to the following statements in the spaces to the right of each comment. The systems or methods referred to are organic and conventional farming methods.

a. Both systems conserve soil by replacing organic matter, recycling nutrients, and taking steps to prevent soil erosion.	<i>True</i>
b. Both systems use renewable natural resources.	<i>True</i>
c. Both use chemical pesticides.	<i>False</i>
d. Both methods claim high levels of productivity from soils.	<i>True</i>
e. Both systems use minimum amounts of non-renewable resources such as commercial fertilizers.	<i>False</i>
f. Both remove the same amount of nutrients from the soil when the same amount of crops are harvested.	<i>True</i>
g. Both methods must replace the nutrients that are removed from the soil, or the soil will be less fertile.	<i>True</i>

7. Based on the answers to question 6., what are the main differences between conventional and organic farming?

Organic farmers do not use chemical pesticides, and they utilize a minimum of commercial fertilizers.

Follow-Up Activities

Extra Help

The concept of sustainable agriculture implies several things. Circle the words in the following list that apply to it.

lasting

non-renewable

renewable

recycling

eroded

polluted

conservation

continuing

urbanization

degraded

Enrichment

Enrichment A

1. Which plants survived the longest?

Plants which receive the least salt will last longer than plants that obtain more salt.

2. Which plants germinated (sprouted) most quickly?

The seeds which receive normal water should germinate first. Increased salt will slow the germination of plants. Some plants receiving salted water will not germinate at all.

As an Extension Activity, some students may try growing several types of plants in salty soils to see which plants have a higher tolerance to salt.

Enrichment B

You are a member of a United Nations committee that is meeting to discuss the worldwide problem of soil erosion. Various people have described difficulties in their countries. They are asking members of the committee (including you!) for solutions.

What are your solutions?

Problem 1: *The best solution to this problem is to stop the clearing of land – it is unsuited for agriculture.*

Problem 2: *Without a supply of water the process can be slowed, but not stopped, with windbreaks and trash cover. The area is so large that massive irrigation is required to stop the spread of the desert.*

Problem 3: *Reforestation and terracing would reduce the amount of runoff from steep mountain slopes. This would reduce the amount of erosion from hillsides and lessen the seriousness of flooding in the lowlands.*

- Note:**
1. The student should now complete the assignment for Section 4 in the Module 1 Assignment Booklet.
 2. Check to see that all assignments have been completed and that all written work is done neatly in blue or black ink. Diagrams may be left in pencil.
 3. Help your student complete the Student Questionnaire which follows.
 4. The completed Assignment Booklet and Student Questionnaire should now be submitted to the Alberta Distance Learning Centre for correction. The student can proceed with the next module while waiting for the return of the Assignment Booklet.

Learning Facilitator: *Please help your student complete this form and return it with the first Assignment Booklet.*

STUDENT QUESTIONNAIRE FOR AGRICULTURE YEAR TWO

Name _____ File Number _____
Address _____ Telephone Number _____
_____ Age _____
_____ Date _____

1. Provide details of the last agriculture course (if any) you completed successfully.

Course: _____ Year Completed: _____

School: _____ Final Mark: _____

2. What school are you attending now (if any)? _____

3. Are you working on this course ☐ at home ☐ at school ☐ both

4. Are there other students in your school or district taking correspondence courses? ☐ Yes ☐ No

5. Are there any other students in your school taking this course by correspondence? ☐ Yes ☐ No

6. What other courses are you taking by correspondence? _____

7. Have you taken correspondence before? ☐ Yes ☐ No If yes, when _____

8. Why are you taking correspondence now? _____

9. Mention any special factors (handicaps, illness, family problems, etc.) which may influence your progress in your studies.

In order to get to know you better, we would like you to tell us a bit about yourself. Write a paragraph or two telling us about yourself and your plans for the future, or anything else that you think is interesting.

Please attach a recent
photo of yourself if
possible.

Name of Student _____

Student I.D. # _____

Name of School _____

Date _____



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Agriculture Year 2

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